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WA-45-1020

**ASAMERA-CANNON MINE CLASS II INSPECTION;
MARCH 10-11, 1987**

by
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ABSTRACT

A Class II inspection was conducted at the Asamera-Cannon Gold Mine on March 10 and 11, 1987. Inspection monitoring did not find surface or ground water impacts attributable to the mining operation. The Asamera water quality monitoring program was generally acceptable and sampling procedures reasonable. Recommendations related to several aspects of the monitoring program are made.

INTRODUCTION

A Class II inspection was conducted at the Asamera-Cannon Mine on March 10 and 11, 1987. Conducting the inspection was Marc Heffner of the Washington State Department of Ecology Water Quality Investigations Section with the help of Marie Garrett, the Cannon Mine Environmental Specialist, and her assistant Gordon Elliott.

The inspection was conducted to meet the following objectives:

1. Inspect the facility and evaluate the monitoring network.
2. Review monitoring procedures.
3. Conduct a laboratory quality assurance check by splitting samples for analysis by both Asamera and Ecology.

SETTING

The Cannon Mine is an active gold mine located in Chelan County at the southeast corner of Wenatchee. Operation began in mid-1985. The mine is below ground with on-site surface activities including a mill, a tailings pond, and a silica pit. Because of the mine's proximity to Wenatchee, the mining operation is designed to prevent significant surface subsidence. To accomplish this, mined areas are filled with cemented material as mining is completed in an area.

Wastewater generation in the mill comes from the flotation process used to concentrate mined material. The material is dried using a filter press and shipped off site for smelting. The filtrate enters a recycle stream. Waste solids are thickened with the water being reused and the concentrated solids sent to the tailings pond.

The tailings pond lies behind a large earthen dam in Dry Gulch. The natural intermittent drainage is routed around the dam via a steel conduit/sediment basin system that

discharges below the dam. Tailings are dispersed along the upstream face of the dam to encourage solids build-up along the dam face and water to pool in the upper end of the pond. A pump station in the pond pumps water back to the mill for reuse.

Activity at the silica pit was minimal during the inspection, but the silica is a potential source of mine fill material. Sand from a small pit near the mill was being used for fill during the inspection.

PROCEDURES

The Asamera monitoring network consists of both surface water and ground water stations (Figure 1).

Ground water sampling consists of static water level only and static water level plus water quality wells. At all wells the static water level is measured first using an electric tape. Wells sampled for water quality are equipped with a dedicated bladder pump. The pump is run to purge two well casing water volumes. A sample is collected for field pH, temperature, and conductivity measurements. An in-line 0.45 um filter is then installed on the pump discharge line and samples are collected. The samples are preserved as required and shipped to a contract laboratory for analysis.

Asamera sampling procedures were followed during the inspection. Samples collected were split for analysis by Asamera and Ecology. Parameters analyzed and sampling times are noted in Table 1. Additional conductivity measurements and collection of unfiltered samples by Ecology are also noted in Table 1.

Surface water samples are analyzed for the same field and laboratory parameters. Instantaneous flow measurements are made at H-weirs installed in the stream beds. Ecology bucket-and-stopwatch instantaneous measurements were made at the same time. The Asamera contract laboratory filters some of the high suspended solids samples prior to analysis as necessary. Samples were split for Asamera and Ecology analysis. Parameters measured and sampling times are included on Table 1.

RESULTS AND DISCUSSION

Sampling and preservation methods used by Asamera appeared appropriate for the parameters being analyzed. Directing the pump discharge farther away from the well casing when purging is suggested to avoid possible well contamination.

Ecology and Asamera analytical results are compared in Table 2. Asamera field temperature and conductivity results did not compare well with Ecology results. Use of an ASTM approved thermometer and check of the Asamera conductivity meter with

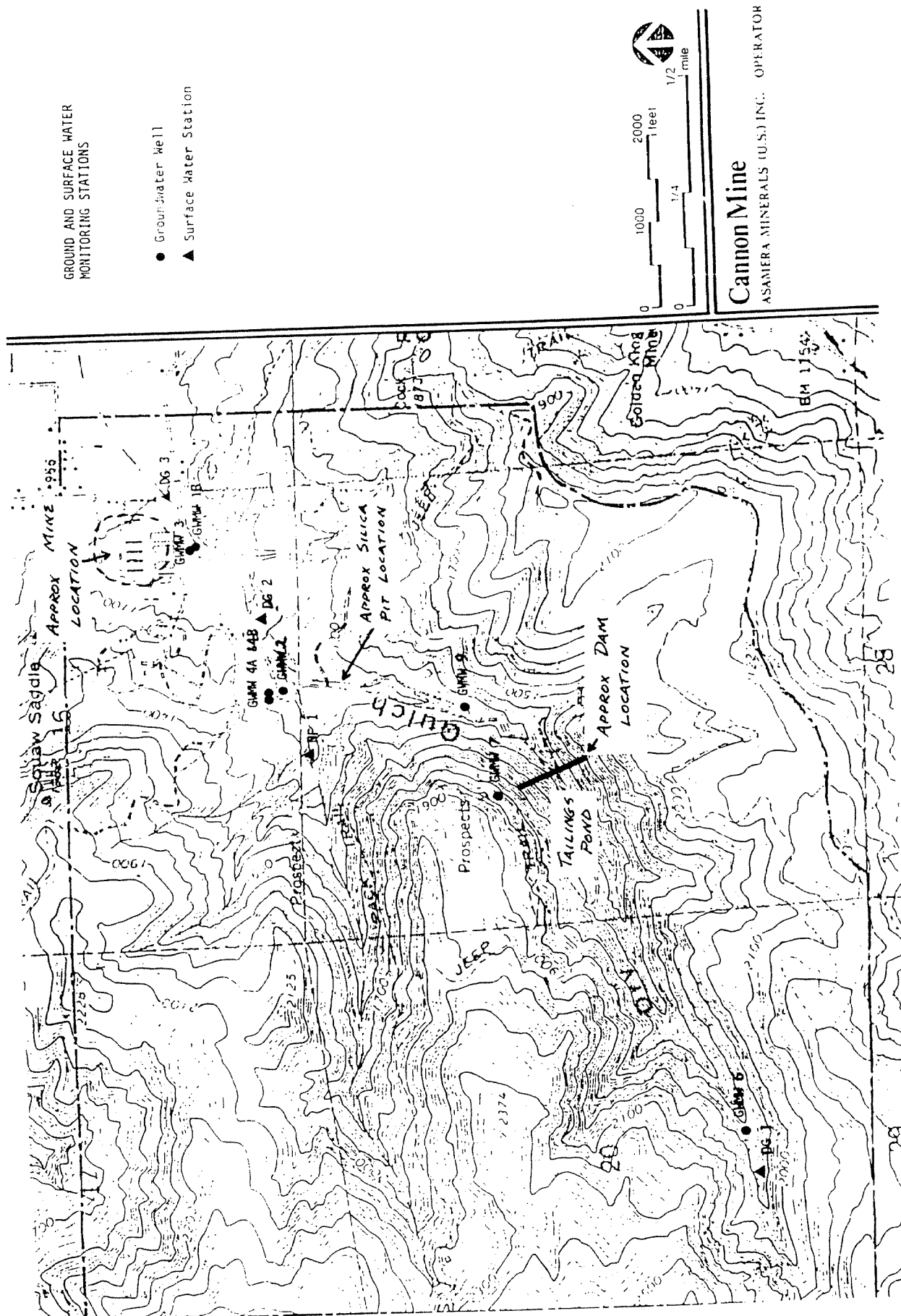


Figure 1. Site map (from Garrett, 1987) - Asamera, March 1987.

Table 1. Sampling Schedule - Asamera, 3/87.

| Station | Date | Time | Laboratory | Field Analyses* | | | | Laboratory Analyses** | | | | | | | | | | | | Comment | |
|---------------|------|------|------------|-----------------|--------------|----|---------------|-----------------------|--------------|----------|---------|------------|---------|-----|-----|-----|------|--------|------|------------|------------|
| | | | | Temperature | Conductivity | pH | Depth to G.W. | Flow Rate | Conductivity | Chloride | Sulfate | T. Cyanide | Cyanate | TSS | TDS | TOC | Iron | Sodium | Zinc | | Manganese |
| GROUND WATER | | | | | | | | | | | | | | | | | | | | | |
| GWMW 6 | 3/10 | 1415 | Asamera | | | | X | | | | | | | | | | | | | | |
| | | 1435 | Ecology | X | X | | | | | | | | | | | | | | | | |
| | | 1515 | Asamera | X | | | | | | | | | | | | | | | | | |
| | 3/12 | 1610 | Ecology | X | X | | | X | X | X | | X | X | X | X | X | X | X | X | Unfiltered | |
| | | | Ecology | | | | | | X | X | X | X | X | X | X | X | X | X | X | | |
| GWMW 9 | 3/10 | 1015 | Asamera | | | | X | | | | | | | | | | | | | | |
| | | 1025 | Ecology | X | X | | | | | | | | | | | | | | | | |
| | | 1030 | Ecology | X | X | | | | | | | | | | | | | | | | |
| | | 1110 | Ecology | X | X | | | | | | | | | | | | | | | | |
| | | 1130 | Ecology | X | X | | | | | | | | | | | | | | | | |
| GWMW 4B | 3/10 | 1140 | Ecology | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | X | Duplicate | |
| | | | Ecology | | | | | | X | X | X | X | X | X | X | X | X | X | X | Duplicate | |
| | | | Asamera | X | X | | | | X | X | X | X | X | X | X | X | X | X | X | | |
| | | 0920 | Asamera | | | | X | | | | | | | | | | | | | | |
| | | 0915 | Asamera | | | | X | | | | | | | | | | | | | | |
| GWMW 4A | 3/10 | 0945 | Ecology | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | X | | |
| | | | Asamera | X | X | | | | X | X | X | X | X | X | X | X | X | X | X | | |
| | | | Asamera | | | | | | | | | | | | | | | | | | |
| | | | Asamera | | | | | | | | | | | | | | | | | | |
| | | | Asamera | | | | | | | | | | | | | | | | | | |
| GWMW 2 | 3/10 | 0925 | Asamera | | | | X | | | | | | | | | | | | | | |
| | | | Asamera | | | | | | | | | | | | | | | | | | |
| | | | Asamera | | | | | | | | | | | | | | | | | | |
| | | | Asamera | | | | | | | | | | | | | | | | | | |
| | | | Asamera | | | | | | | | | | | | | | | | | | |
| GWMW 3 | 3/11 | 0830 | Asamera | | | | X | | | | | | | | | | | | | | |
| | | | Asamera | | | | | | | | | | | | | | | | | | |
| | | | Ecology | X | X | | | | X | X | X | X | X | X | X | X | X | X | X | X | Unfiltered |
| | | | Ecology | | | | | | | X | X | X | X | X | X | X | X | X | X | X | Filtered |
| | | | Asamera | X | X | | | | | X | X | X | X | X | X | X | X | X | X | X | |
| GWMW 1B | 3/11 | 0830 | Asamera | | | | X | | | | | | | | | | | | | | |
| | | | Asamera | | | | | | | | | | | | | | | | | | |
| | | | Ecology | X | X | | | | X | X | X | X | X | X | X | X | X | X | X | X | |
| | | | Ecology | | | | | | | X | X | X | X | X | X | X | X | X | X | X | |
| | | | Asamera | X | X | | | | | X | X | X | X | X | X | X | X | X | X | X | |
| SURFACE WATER | | | | | | | | | | | | | | | | | | | | | |
| DG 1 | 3/11 | 0920 | Ecology | X | X | | | X | X | X | X | X | X | X | X | X | X | X | X | | |
| | | | Asamera | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | X | | |
| TP | 3/11 | 1000 | Ecology | X | X | | | X | X | X | X | X | X | X | X | X | X | X | X | | |
| | | | Asamera | X | X | X | | | X | X | X | X | X | X | X | X | X | X | X | | |
| Tailings | 3/11 | 1000 | Ecology | | | | | | | | | | | | | | | | | | |
| | | | Ecology | | | | | | | | | | | | | | | | | | |
| NF 1 | 3/11 | 1035 | Ecology | | X | | | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| | | | Asamera | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| DG 3 | 3/11 | 1110 | Ecology | X | X | | | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| | | | Asamera | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| Seep | 3/10 | 1100 | Asamera | | | | | | | X | X | | | X | X | X | X | X | X | | |

*analyzed prior to field filtration

**ground water samples field filtered prior to analysis unless otherwise noted

Table 2. Laboratory comparison - Asamera, 3/87.

| Station | Date | Laboratory | Field Analyses+ | | | Laboratory Analyses++ | | | | | | | | | | | | | | Comment | | |
|---------------|------|-------------------------|-----------------|------|------|-------------------------|-----------|-------------------------|------------------------|----------------|-------------------|----------------|------------|------------|------------|-------------|---------------|-------------|------------------|---------|--|--|
| | | | Temp. | (C) | (F) | Conductivity (umhos/cm) | pH (S.U.) | Conductivity (umhos/cm) | Chloride (mg/L as Cl-) | Sulfate (mg/L) | T. Cyanide (mg/L) | Cyanate (mg/L) | TSS (mg/L) | TDS (mg/L) | TOC (mg/L) | Iron (ug/L) | Sodium (mg/L) | Zinc (u/gl) | Manganese (ug/L) | | | |
| | | | | | | | | | | | | | | | | | | | | | | |
| GROUND WATER | | | | | | | | | | | | | | | | | | | | | | |
| GWMW 6 | 3/12 | Ecology Asamera | | | | 880 | 16 | 117 | <0.005 | 1.4j | 10 | 685h | 82z | 900 | 181 | 24 | 113 | | | | | |
| | | | | | | | 20 | 161 | <0.003 | <0.1 | | 697 | 9.5 | 330 | 180 | 80 | 40 | | | | | |
| GWMW 9 | 3/10 | Ecology Ecology Asamera | 11.1 | 52.0 | 1060 | 7.1 | 1130 | 70 | 31 | <0.005 | 0.18 | 1 | 670 | 11 | 800 | 152 | 8 | 80 | Duplicate | | | |
| | | | | | | | 1120 | 68 | 33 | <0.005 | 0.06 | <1 | 650 | 14 | 1170 | 150 | 6 | 85 | Duplicate | | | |
| | | | | | 580 | 7.1 | | 66 | 31 | <0.003 | <0.1 | | 666 | 1.2 | 610 | 140 | <10 | 40 | | | | |
| GWMW 4A | 3/10 | Ecology Ecology Asamera | 11.3 | 52.3 | 1300 | 6.7 | 1350 | 54 | 200 | 0.008 | 0.19 | <1 | 850 | 18 | 190 | 65 | 3 | 4 | | | | |
| | | | 10.6 | 51 | 735 | 6.6 | | 51 | 192 | <0.003 | <0.1 | | 866 | 1.2 | 10 | 56 | <10 | <10 | | | | |
| GWMW 3 | 3/11 | Ecology Ecology Asamera | 12.5 | 54.5 | 1900 | | 1860 | 380 | 100 | <0.005 | 0.08 | <1 | 980 | 9.0 | 450 | 308 | 5 | 345 | | | | |
| | | | 12.2 | 54 | 1360 | 6.9 | | 436 | 74 | 0.005 | <0.1 | | 1093 | 0.9 | 30 | 340 | <10 | 260 | | | | |
| GWMW 1B | 3/11 | Ecology Ecology Asamera | 12.4 | 54.3 | 2900 | | 2860 | 940 | 12 | <0.005 | 1.4 | <1 | 1300 | 6.1 | 390 | 554 | 7 | 47 | | | | |
| | | | 10.6 | 51 | 1625 | 6.6 | | 740 | 10 | <0.003 | <0.1 | | 1410 | <0.6 | 20 | 550 | <10 | 40 | | | | |
| SURFACE WATER | | | | | | | | | | | | | | | | | | | | | | |
| DG 1 | 3/11 | Ecology Ecology Asamera | 5.7 | 42.3 | 250 | | 242 | 2.0 | 18 | <0.005 | 0.06 | 690 | 340 | 18 | 37900 | 28 | 106 | 248 | | | | |
| | | | 7.8 | 46 | <400 | 6.4 | | 4 | 19 | <0.003 | <0.1 | | 312 | 11.0 | 900 | 23 | <10 | <10 | | | | |
| TP | 3/11 | Ecology Ecology Asamera | 10.8 | 51.4 | 2200 | | 2360 | 230 | 720 | 0.058 | <0.01 | 57 | 1500 | 13 | 1700 | 352 | 9 | 81 | | | | |
| | | | 9.4 | 49 | 1400 | 9.1 | | 211 | 662 | | | | 1539 | 3.6 | 60 | 380 | <10 | <10 | | | | |
| NF 1 | 3/11 | Ecology Ecology Asamera | 10.6 | 51 | 410 | 7.8 | 709 | 5.4 | 35 | 0.005 | 0.05 | 4 | 330 | 13 | 580 | 25 | 5 | 12 | | | | |
| | | | | | | | | 9 | 29 | <0.003 | <0.1 | | 393 | 1.2 | <10 | 17 | <10 | <10 | | | | |
| DG 3 | 3/11 | Ecology Ecology Asamera | 8.4 | 47.1 | 390 | | 366 | 9.0 | 49 | 0.005 | 0.16 | 1200 | 360 | 21 | 62800 | 31 | 743 | 365 | | | | |
| | | | 10.6 | 51 | <400 | 7.2 | | 12 | 65 | <0.003 | <0.1 | | 254 | 13.0 | 170 | 25 | 10 | <10 | | | | |

z = Sample low due to interfering substance

h = Over holding time. Analysis run.

j = Estimated value

+ = No filtration prior to analysis

++ = Ground water samples field-filtered prior to laboratory analysis unless otherwise noted

a standard solution are recommended. Asamera pH measurements appeared accurate. Most laboratory results compared favorably. Some differences in total organic carbon (TOC), iron, and manganese results occurred. Submission of a blind known and/or spike to the contract lab along with samples is a suggested quality assurance practice.

A tailings pond (TP) water sample was collected as part of the inspection. The data were compared to the upgradient stream (DG1) and well (GWMW6) samples to determine which parameters might indicate mining impacts (Figure 2). Chloride, sodium, sulfate, conductivity, and total dissolved solids (TDS) were selected for further comparisons. Routine collection and analysis of a tailings pond water sample is suggested to help identify indicator parameters. Also, inclusion of a sample representative of water in the mine could provide similar information. Parameters tested may be reduced if TP and mine parameters are consistent over time.

Use of the baseline data collected by Asamera prior to opening of the mine was briefly considered. The data appeared widely scattered, making determination of changes over time impractical in this report.

Surface Water

Surface water flows in the Dry Gulch Basin are intermittent. Previous investigation showed that monitoring stations DG1, NF1, and DG3 were dry from June through December in 1986 (Garrett, 1987). Dry Gulch Creek did not flow above ground in all portions of the Asamera reach during the inspection.

Inspection flow data are summarized in Table 3. Heavy silting is a problem with the H-flumes necessitating cleaning before measuring. The flume measurements compared well with the Ecology bucket-and-stopwatch measurements. Flow was less at DG3 than at DG1 during the inspection.

Table 3. Surface water flow rates - Asamera, 3/87.

| Station | Asamera Measurement* (cfs) | Ecology Measurement** (cfs) |
|---------|----------------------------------|-----------------------------------|
| DG 1 | 0.09 | 0.08 |
| DG 3 | 0.04 | 0.04 |
| NF 1 | 0.02 | 0.02 |

* = Asamera instantaneous measurement made using installed H-flumes

** = Ecology instantaneous measurement made using bucket-and-stopwatch method

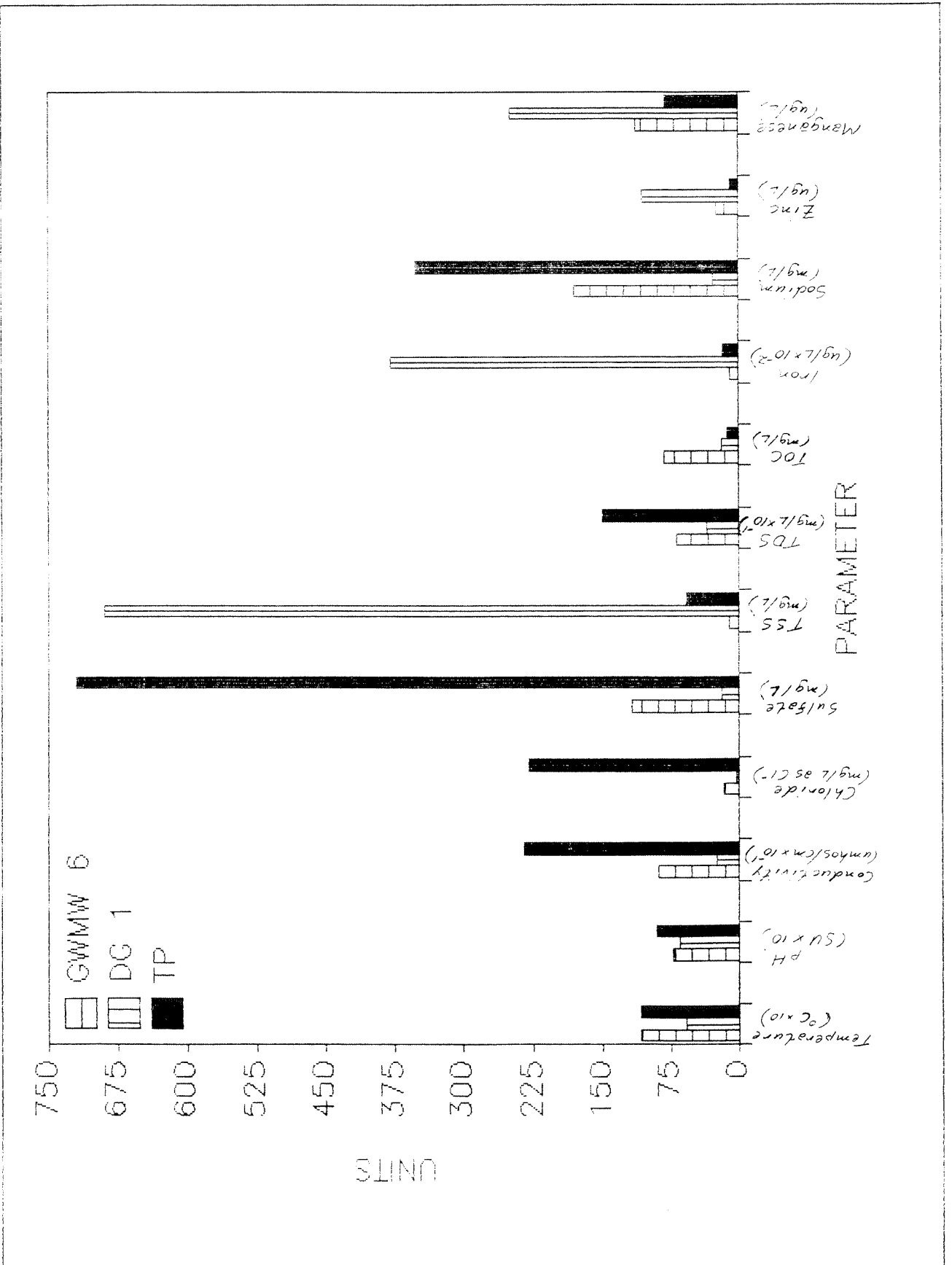


Figure 2. Comparison of upgradient stations to tailings pond - Asamera, March 1987.

Surface water quality data are presented in Table 4. The DG1 sample indicated that the creek is heavily laden with solids upstream of the Asamera reach. Figure 3 compares in-stream concentrations to parameters that were high in the tailings pond. The seep sample data, which was collected from a small pond directly below the dam, suggested that the seep was being influenced by the tailings pond. The seep pond had no outlet and did not appear to be any cause for concern. The discontinuous nature of the stream and poor upstream quality make determination of mine-related impacts difficult. Figure 3 suggests that water used in the mill was not contaminating the surface streams.

Asamera surface activities and on-site dirt roads suggest that total suspended solids (TSS) concentrations should be routinely monitored at the surface water monitoring stations as an indicator of excessive surface disturbance. High TSS concentrations at the upstream station may make data interpretation difficult.

Routine maintenance of the channelized upper portion of Dry Gulch Creek is necessary. The flow is routed through a series of conduits and settling basins. During the inspection the sediment levels in the basins were high. Regular cleaning is recommended to prevent overland flow due to basin walls being breached.

Ground Water

Ground water data are summarized in Table 5. Figure 4 compares selected monitoring well parameters to the tailings pond data. As with the surface water, no clear impacts on the ground water due to mining activities were noted. GWMW3 and GWMW1B had higher chloride and sodium concentrations and higher conductivities than the background well (GWMW6). These same parameters were high in the tailings pond. The sulfate concentrations in GWMW3 and 1B were lower than background while the tailings pond had a high concentration. Thus, association of the changes with mining activities is not possible.

GWMW3 and 1B are in the vicinity of the mine. Routine collection of a representative sample from the mine is recommended for comparison with well data. A monitoring well located downgradient of the mine is also suggested.

Ground water elevation data are presented in Table 6. Also included in the table is the distance from the ground water surface to the well screen. The upgradient wells (GWMW6 and GWMW9) are screened roughly 100 feet into the ground water. Screening wells closer to the ground water surface, particularly GWMW9, may prove more useful in detecting any changes due to mining activities.

Several of the wells had a characteristic hydrogen sulfide odor when being pumped. Analysis of both sulfate and sulfide is suggested to more reasonably monitor sulfur in the system.

Table 4 - Ecology Surface Water Analytical Results - Asamera, 3/87.

| Station | Date | Time | Field Analyses | | | | Laboratory Analyses | | | | | | | | | | | | | |
|----------|------|------|----------------|------|------|-------------------------|---------------------|-----------------|-------------------------|------------------------|----------------|----------------------|----------------|------------|------------|------------|-------------|---------------|-------------|------------------|
| | | | Temp. | (C) | (F) | Conductivity (umhos/cm) | pH+ (S.U.) | Flow Rate (cfs) | Conductivity (umhos/cm) | Chloride (mg/L) as Cl- | Sulfate (mg/L) | Total Cyanide (mg/L) | Cyanate (mg/L) | TSS (mg/L) | TDS (mg/L) | TOC (mg/L) | Iron (ug/L) | Sodium (mg/L) | Zinc (ug/L) | Manganese (ug/L) |
| | | | | | | | | | | | | | | | | | | | | |
| DC 1 | 3/11 | 0920 | 5.7 | 42.3 | 250 | 6.4 | 0.08 | 242 | 242 | 2.0 | 18 | <0.005 | 0.06 | 690 | 340 | 18 | 37900 | 28 | 106 | 248 |
| TP | 3/11 | 1000 | 10.8 | 51.4 | 2200 | 9.1 | | 2360 | 230 | 720 | 0.058 | <0.01 | 57 | 1500 | 13 | 1700 | 352 | 9 | 81 | |
| Seep | 3/10 | 1100 | | | | | | | 96+ | 334+ | | | | 1102+ | 2.1+ | <10+ | 100+ | <10+ | 10+ | |
| Tailings | 3/11 | 1000 | | | | | | | | | | | | | | 1.1* | 1620** | 625** | 28** | 408** |
| NF 1 | 3/11 | 1035 | ++ | ++ | 700 | 7.8 | 0.02 | 709 | 5.4 | 35 | 0.005 | 0.05 | 4 | 330 | 13 | 580 | 25 | 5 | 12 | |
| DG 3 | 3/11 | 1110 | 8.4 | 47.1 | 390 | 7.2 | 0.04 | 366 | 9.0 | 49 | 0.005 | 0.16 | 1200 | 360 | 21 | 62800 | 31 | 743 | 365 | |

+ = Asamera measurement
 * = Percent dry basis - 32.1 percent moisture
 ** = mg/Kg dry weight
 ++ = Thermometer broke

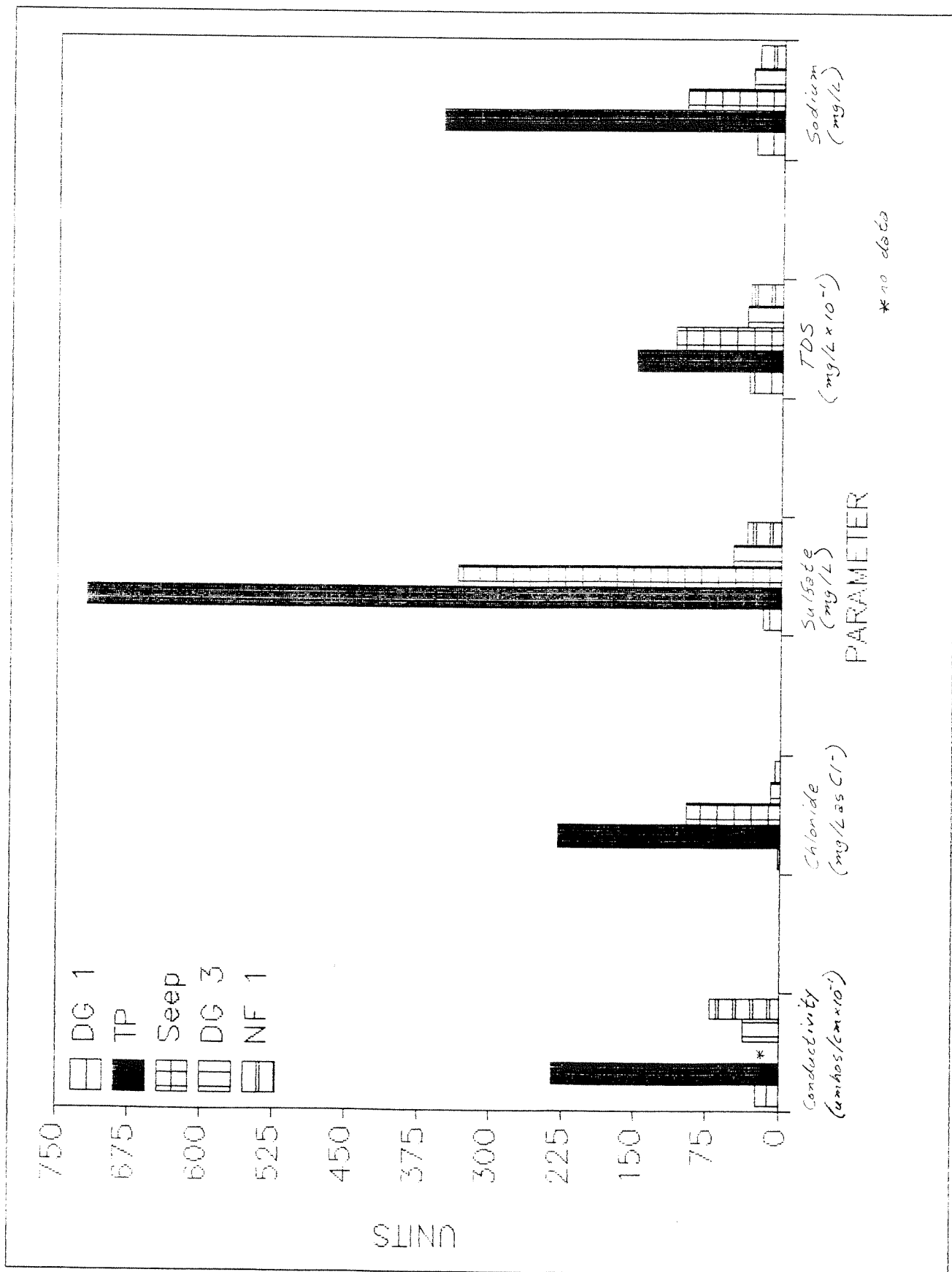


Figure 3. Comparison of surface water stations to tailings pond - Asamera, March 1987.

Table 5. Ecology Ground Water Analytical Results - Asamera, 3/87.

| Field Analyses++ | | | | | | | | | | Laboratory Analyses*** | | | | | | | | | | Comment |
|------------------|------|------|-------|------|----------------------------|-------------|--------------------------------|----------------------------|---------------------------|------------------------|-------------------------|----------------|------------|------------|------------|-------------|---------------|-------------|------------------|------------|
| Station | Date | Time | Temp. | | Conductivity (umhos/cm) | pH** (S.U.) | Screen Elevation* (ave.-ft) | Conductivity (umhos/cm) | Chloride (mg/L) as Cl- | Sulfate (mg/L) | Total Cyanide (mg/L) | Cyanate (mg/L) | TSS (mg/L) | TDS (mg/L) | TOC (mg/L) | Iron (ug/L) | Sodium (mg/L) | Zinc (ug/L) | Manganese (ug/L) | |
| | | | (C) | (F) | | | | | | | | | | | | | | | | |
| GWMW 6 | 3/10 | 1435 | 11.3 | 52.3 | 440 | | 1728 | | | | | | | | | | | | | |
| | | 1515 | 11.1 | 52.0 | 650 | 7.2 | | 868 | 12 | 110 | <0.005 | | 150 | 620 | 17 | 5480 | 186 | 57 | 126 | Unfiltered |
| | | 1610 | 10.8 | 51.4 | 900 | | | 880 | 16 | 117 | <0.005 | 1.4j | 10 | 685h | 82z | 900 | 181 | 24 | 113 | |
| | 3/12 | * | | | | | | | | | | | | | | | | | | |
| GWMW 9 | 3/10 | 1025 | 11.3 | 52.3 | 1200 | | 1238 | | | | | | | | | | | | | |
| | | 1030 | 11.3 | 52.3 | 1200 | | | | | | | | | | | | | | | |
| | | 1110 | 11.3 | 52.3 | 1040 | | | | | | | | | | | | | | | |
| | | 1130 | 11.3 | 52.3 | 1100 | | | | | | | | | | | | | | | |
| | | 1140 | 11.1 | 52.0 | 1060 | 7.1 | | 1130 | 70 | 31 | <0.005 | 0.18 | 1 | 670 | 11 | 800 | 152 | 8 | 80 | Duplicate |
| GWMW 4A | 3/10 | 0945 | 11.3 | 52.3 | 1300 | 6.6 | 1035 | | | | | | | | | | | | | |
| | | | | | | | | 1120 | 68 | 33 | <0.005 | 0.06 | <1 | 650 | 14 | 1170 | 150 | 6 | 85 | Duplicate |
| | | | | | | | | 1350 | 54 | 200 | 0.008 | 0.19 | <1 | 850 | 18 | 190 | 65 | 3 | 4 | |
| | | | | | | | | 2090 | 530 | 70 | <0.005 | <0.01 | <1 | 1100 | 5.6 | 440 | 377 | 5 | 303 | Unfiltered |
| GWMW 3 | 3/11 | 1140 | 12.5 | 54.5 | 1900 | 6.9 | 839 | | | | | | | | | | | | | |
| | | | | | | | | 1860 | 380 | 100 | <0.005 | 0.08 | <1 | 980 | 9.0 | 450 | 308 | 5 | 345 | Filtered |
| GWMW 1B | 3/11 | 1220 | 12.4 | 54.3 | 2900 | 6.6 | 809 | | | | | | | | | | | | | |
| | | | | | | | | 2860 | 940 | 12 | <0.005 | 1.4 | <1 | 1300 | 6.1 | 390 | 554 | 7 | 47 | |

* = Due to sampling problems on March 10, sample collected on March 12 by Asamera

z = Sample low due to interfering substance

h = Over holding time. Analysis run.

j = Estimated value

** = Asamera measurements

*** = Ground water samples field-filtered prior to analysis unless otherwise noted

+++ = No filtration prior to analysis

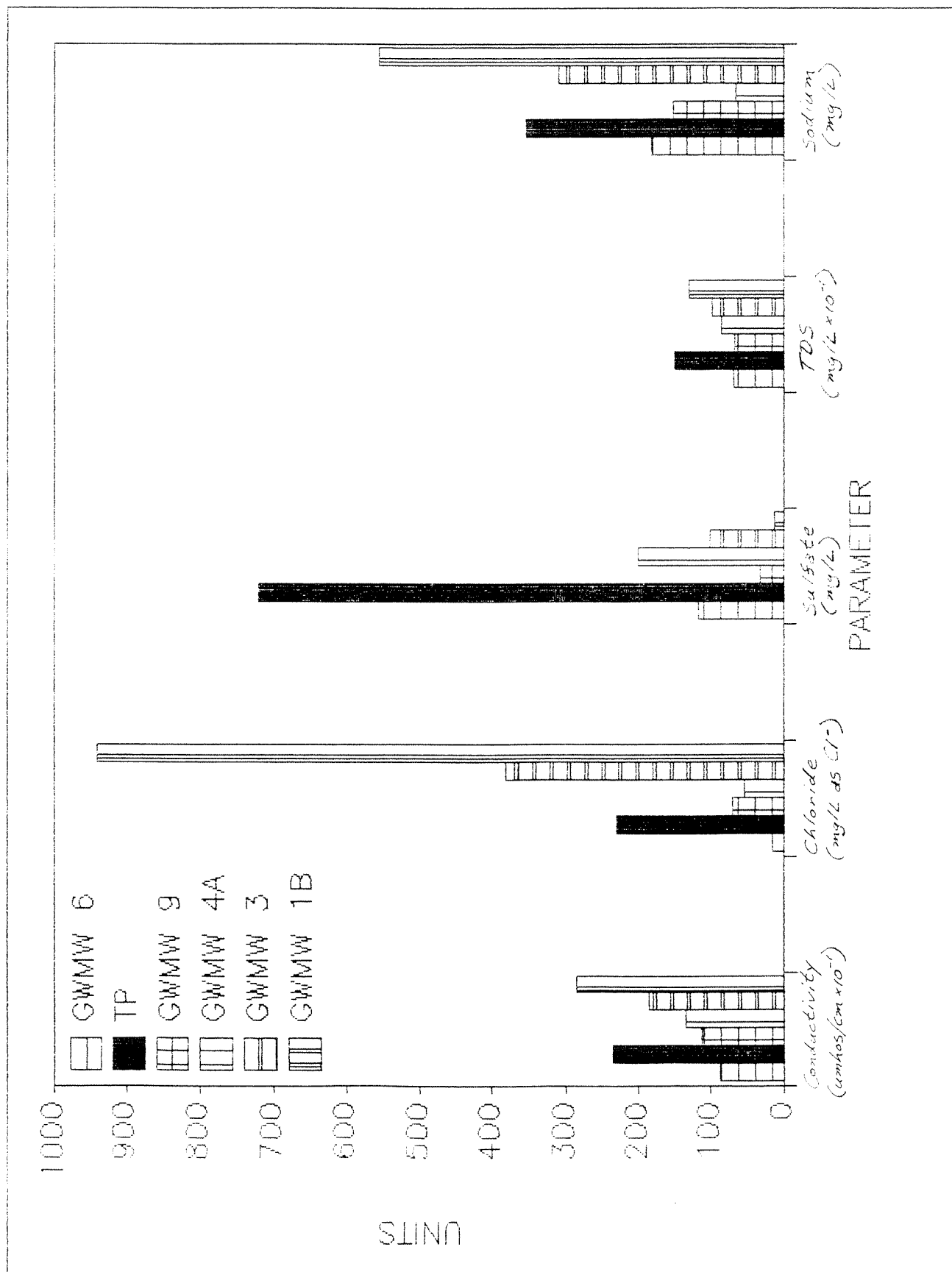


Figure 4. Comparison of ground water stations to tailings pond - Asamera, March 1987.

Table 6. Groundwater elevation measurements* - Asamera, 3/87.

| Well | Well Cap Elevation (ft) | Depth to Groundwater (ft) | Groundwater Elevation (ft) | Depth to Well Screen (avg-ft) | Well Screen Elevation (avg-ft) | Distance - Groundwater Sur- face to Screen (avg-ft) |
|-----------|-------------------------------|---------------------------------|----------------------------------|-------------------------------------|--------------------------------------|--|
| GWMW 6 | 1822.5 | 14.0 | 1808.5 | 95 | 1728 | 80 |
| TP | 1580+ | | 1525++ | | | |
| GWMW 9 | 1357.9 | 15.1 | 1342.8 | 120 | 1238 | 105 |
| GWMW 4B** | 1113.3 | 51.1 | 1062.2 | 99 | 1014 | 48 |
| GWMW 4A | 1114.1 | 53.3 | 1060.8 | 79 | 1035 | 26 |
| GWMW 2** | 1112.8 | 52.5 | 1060.3 | 160 | 953 | 107 |
| GWMW 1B | 1033.1 | 179.0 | 854.1 | 224 | 809 | 45 |
| GWMW 3 | 1033.7 | 182.5 | 851.2 | 195 | 839 | 12 |

* = Measurements made by Asamera

+ = Water surface elevation

++ = Bottom of pool elevation

** = Static height measurement only; no water quality sampling

RECOMMENDATIONS AND CONCLUSIONS

Inspection monitoring did not find surface or ground water impacts attributable to mining activities. The Asamera monitoring program was generally acceptable and sampling procedures reasonable.

Recommendations concerning several aspects of the monitoring program are summarized below:

Analytical

1. Field temperature and conductivity measurements should be improved. Use of a conductivity standard and an ASTM approved thermometer are recommended.
2. A known or spiked quality assurance sample should routinely be submitted to the contract laboratory along with the regular samples.

Station Changes

1. Three additional monitoring stations were recommended for inclusion in the routine network: tailings pond water, mine water, and a well downgradient of the mine.
2. Moving screens to allow collection of samples in GWMW6 and GWMW9 closer to the ground water surface should be considered.

Parameter Changes

1. Two additional parameters were suggested: TSS for the surface water stations and sulfide for the ground water stations.
2. Dropping parameters for which concentrations in the tailings pond water and the mine water are routinely below upgradient concentrations should be considered.

General

1. Pump discharge when purging the monitoring wells should be directed away from the well to avoid contamination.
2. Regular clean-out of the Dry Gulch Creek conduit/settling basin routing system above the tailing pond dam is recommended.

REFERENCES

Garrett, M., 1987. Asamera Minerals (U.S.) Inc., Cannon Mine, Wenatchee, Washington, Environmental Monitoring Program, Fourth Quarter, 1986.